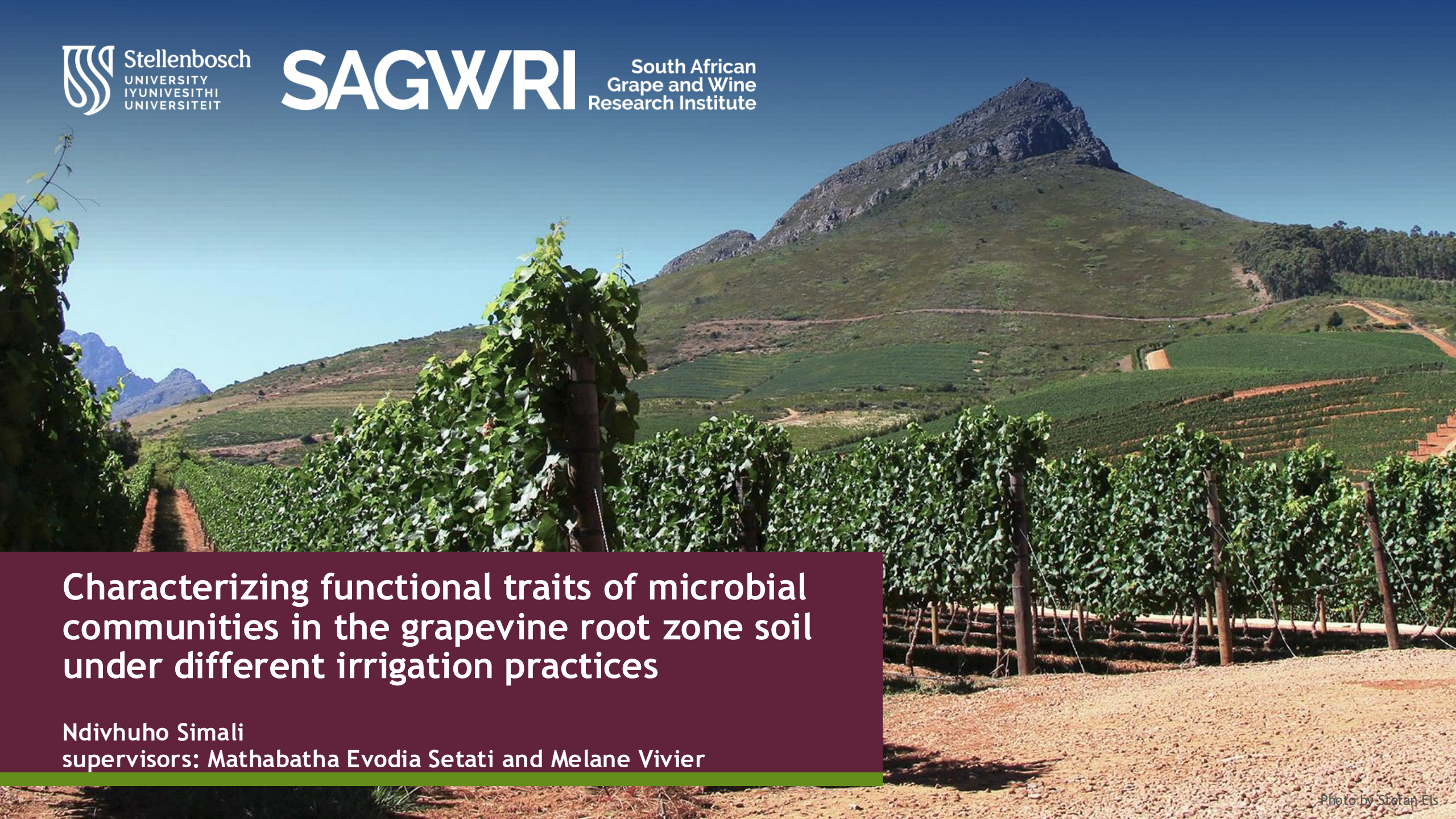

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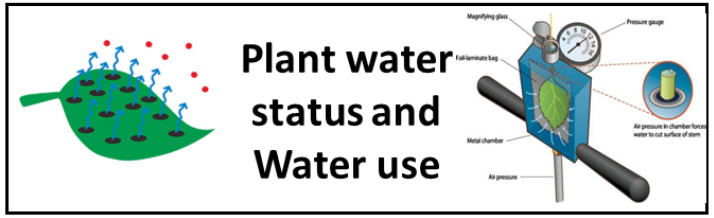
SAGWRI South African Grape and Wine Research Institute

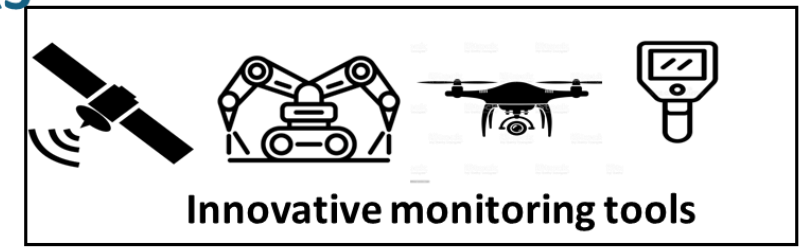
Characterizing functional traits of microbial communities in the grapevine root zone soil under different irrigation practices

Ndivhuho Simali
supervisors: Mathabatha Evodia Setati and Melane Vivier

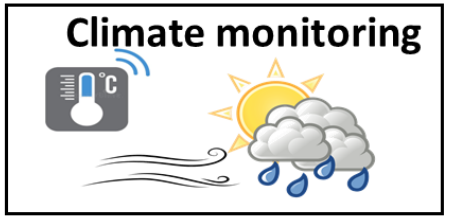
Photo by Stefan Els

MODEL VINEYARD TO STUDY ADAPTABILITY AND RESILIENCE TO WATER LIMITATION OF SCIONS/ROOTSTOCKS





Epigenetics analysis



MODEL VINEYARD

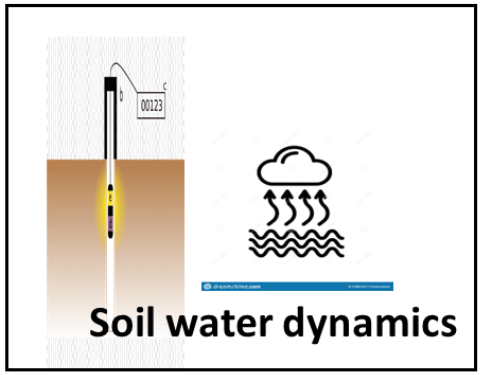
3 CULTIVARS X 2 ROOTSTOCKS

3 WATER REGIMES:
DRYLAND;
REDUCED IRRIGATION;
WELL-WATERED

PERIOD OF STUDY:
FROM PLANTING OVER THE LIFE-CYCLE OF THE VINEYARD

Scion-rootstock interactions
Growth/ development
Biomass/ architecture
Physiology

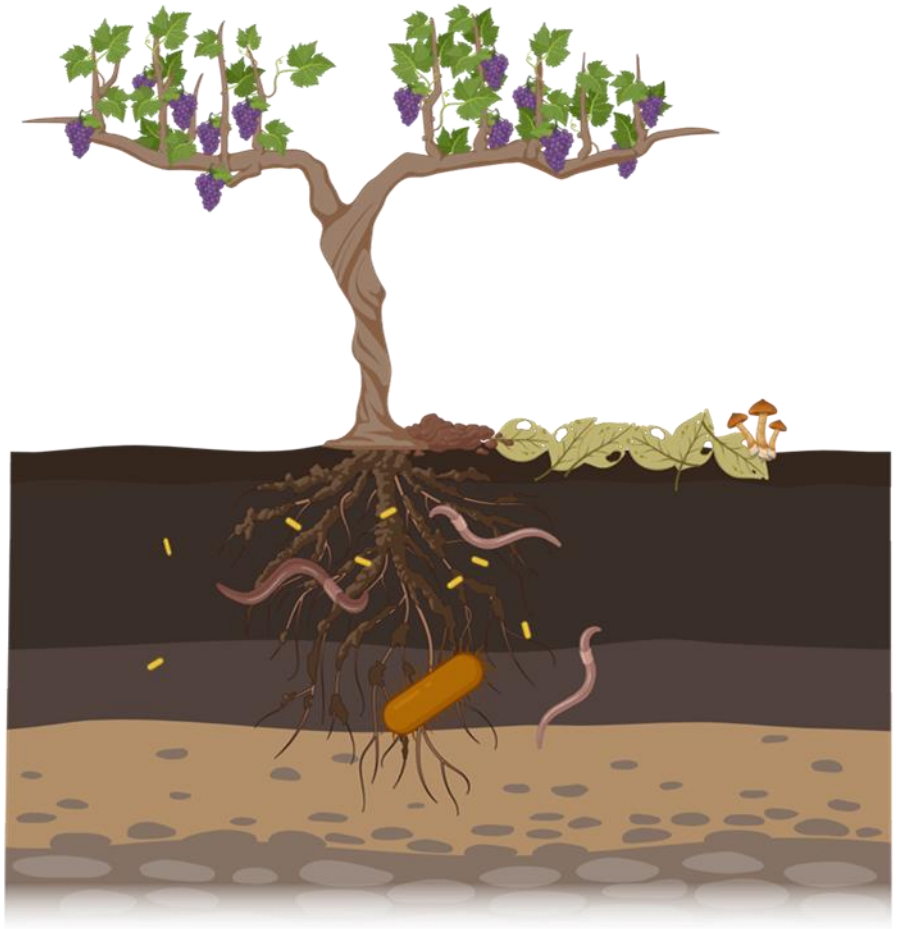
Grape to Wine Analysis
Yield/ berry composition,
Wine composition/Sensory analysis



Root architecture analysis

Soil/root microbiome analysis

Introduction



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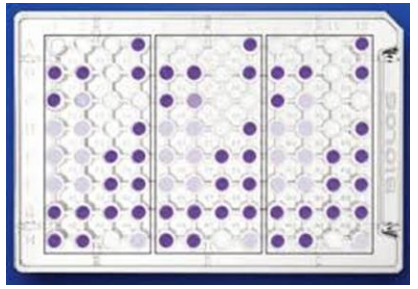
- The microbiota associated with the plant play a crucial role in the response to stress
- Different plant genotypes actively recruit microbiota from bulk soil in the rhizosphere
- This study aimed to analyze the functional diversity of the soil microbial communities in the root zone of Cabernet Sauvignon, Pinotage and Shiraz each grafted onto two rootstocks (US8-7 and Richter 110).
- Three irrigation regimes that follows optimal (L1), moderate deficit (L2), and dryland (D) were applied from the time of planting in a model vineyard located at Stellenbosch University.

Berlanas et al., 2019; Dries et al., 2021a; Wang et al., 2023

Experimental design

- Soil was sampled using a soil auger up to 30cm depth
- 1g of soil with 99ml of water
- 54 samples, 3 biological replicates
- 3 scions × 2 rootstocks × 3 irrigation scenarios × 3 replicate panels

- Shaking at 20ºC for 20min
- Put at 4 degrees for 30min
- 120µl Supernatant was inoculated to the Ecoplate

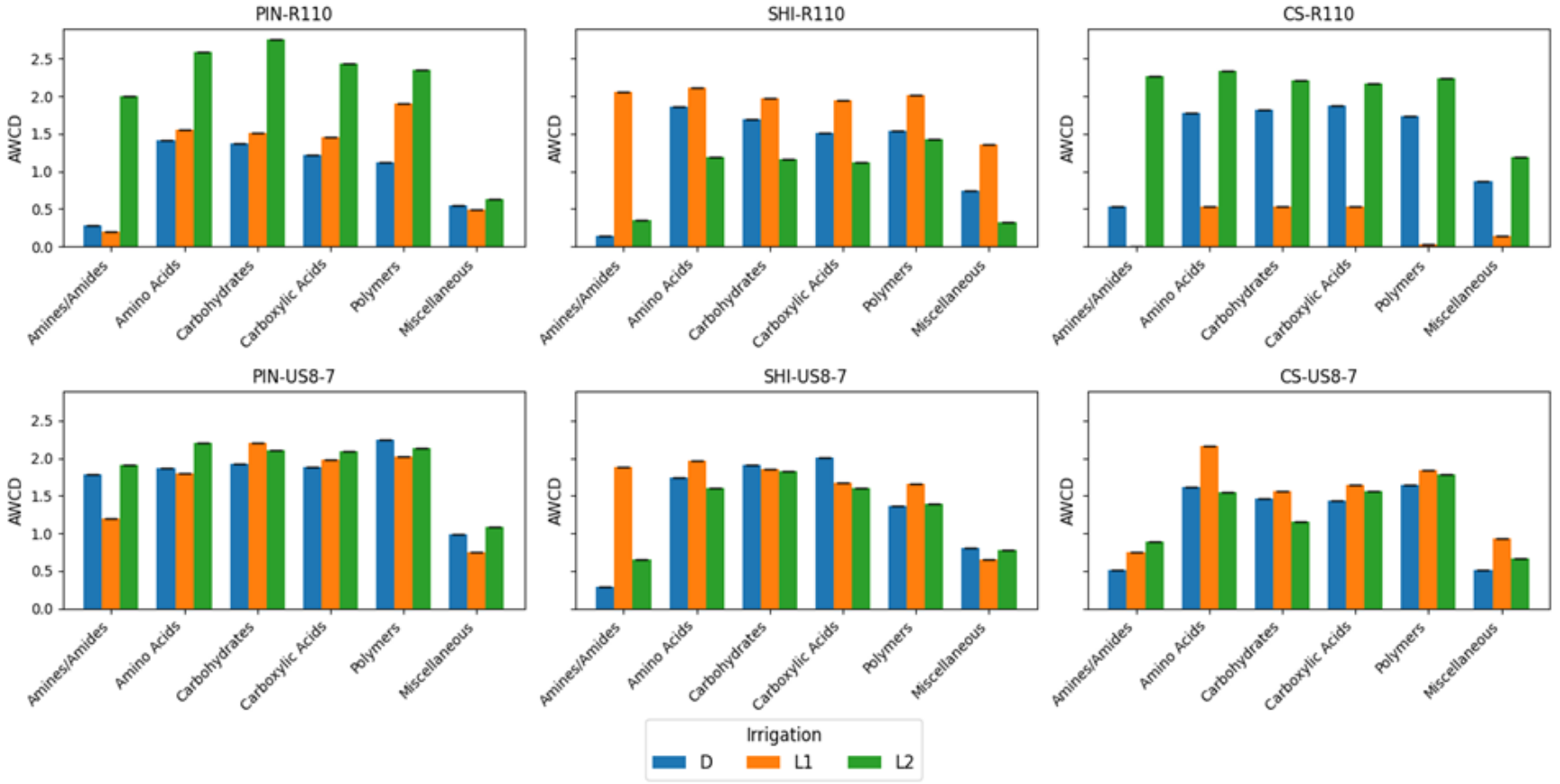


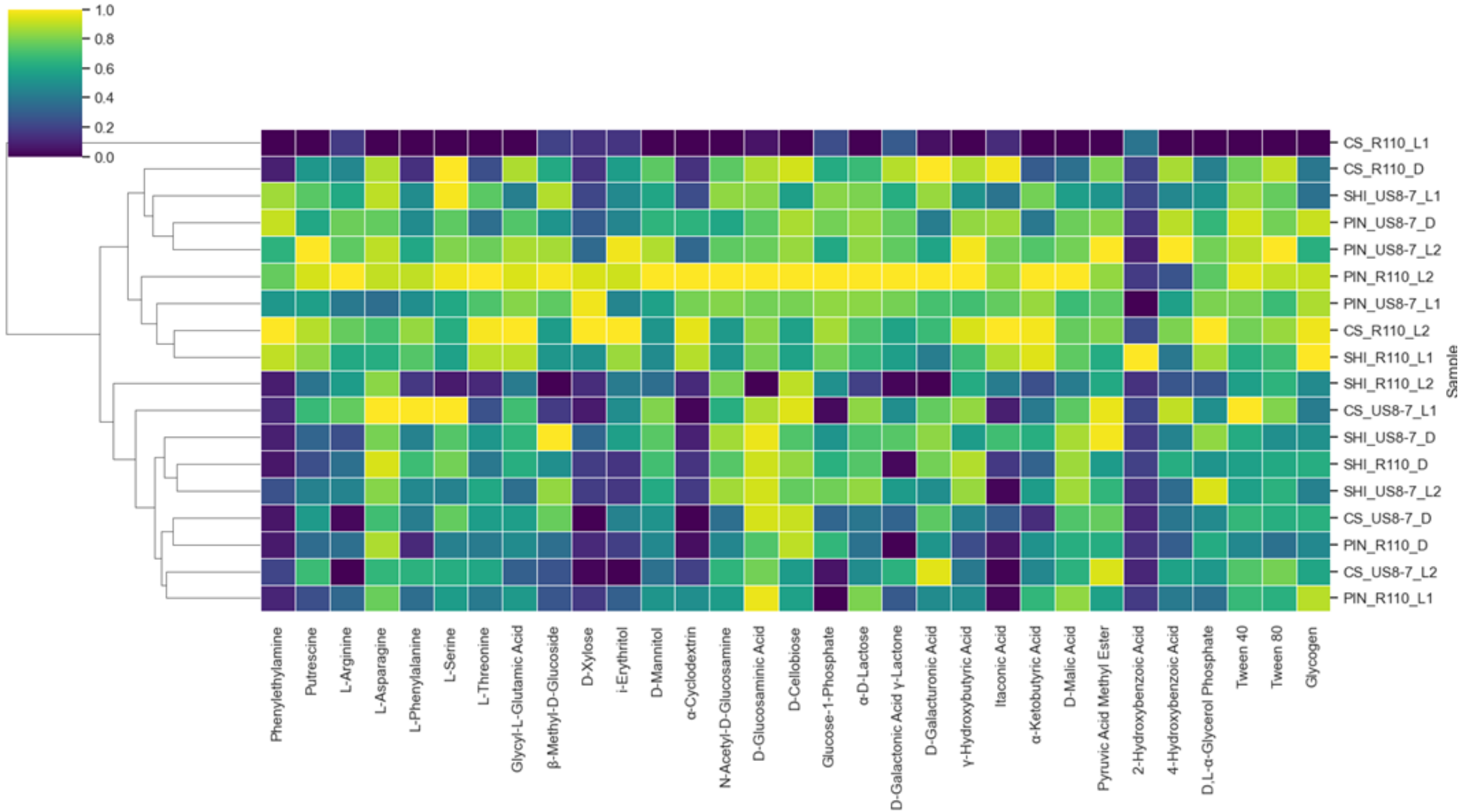
- Biolog Ecoplate (96 well plate)
- 31 C sources and control
- Carbohydrates (n = 10), carboxylic acids (n = 9), amines and amides (n = 2), amino acids (n = 6) and polymers (n = 4)
- Direct inoculation
- Colour change

$$AWCD = \frac{\sum(Absorbance\ of\ each\ well - Absorbance\ of\ control\ well)}{n}$$

Where n= number of carbon wells (93)

- Absorbance measurements at OD590nm
- Every 24hrs for 7 days


PIN-R110
SHI-R110
CS-R110
PIN-US8-7
SHI-US8-7
CS-US8-7
AWCD
0.0
0.5
1.0
1.5
2.0
2.5
Amines/Amides
Amino Acids
Carbohydrates
Carboxylic Acids
Polymers
Miscellaneous
Irrigation
D
L1
L2


1.0
0.8
0.6
0.4
0.2
0.0
CS_R110_L1
CS_R110_D
SHI_US8-7_L1
PIN_US8-7_D
PIN_US8-7_L2
PIN_R110_L2
PIN_US8-7_L1
CS_R110_L2
SHI_R110_L1
SHI_R110_L2
CS_US8-7_L1
SHI_US8-7_D
SHI_R110_D
SHI_US8-7_L2
CS_US8-7_D
PIN_R110_D
CS_US8-7_L2
PIN_R110_L1
Sample
Phenylethylamine
Putrescine
L-Arginine
L-Asparagine
L-Phenylalanine
L-Serine
L-Threonine
Glycyl-L-Glutamic Acid
β-Methyl-D-Glucoside
D-Xylose
i-Erythritol
D-Mannitol
α-Cyclodextrin
N-Acetyl-D-Glucosamine
D-Glucosaminic Acid
D-Cellobiose
Glucose-1-Phosphate
α-D-Lactose
D-Galactonic Acid γ-Lactone
D-Galacturonic Acid
γ-Hydroxybutyric Acid
Itaconic Acid
α-Ketobutyric Acid
D-Malic Acid
Pyruvic Acid Methyl Ester
2-Hydroxybenzoic Acid
4-Hydroxybenzoic Acid
D,L-α-Glycerol Phosphate
Tween 40
Tween 80
Glycogen

Conclusion

- The differences between the irrigation levels within each rootstock/scion are not significantly different due to huge variabilities between samples.
- The carbon utilization patterns varied across irrigation treatments and rootstock-scion combinations.
- However, the rootstock R110 had a trend, showing high carbon utilization on optimal (PIN and CS) and reduced (SHI) irrigated samples.
- Therefore, the rootstock-scion combinations had different microbial activity at different irrigation levels.

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discover diversity in a glass

Thank you
Enkosi
Dankie

Photo by Stefan Els